



The University of Manchester

Visualisation Toolkit (VTK) driver Geant4 collaboration meeting



Stewart Boogert
University of Manchester

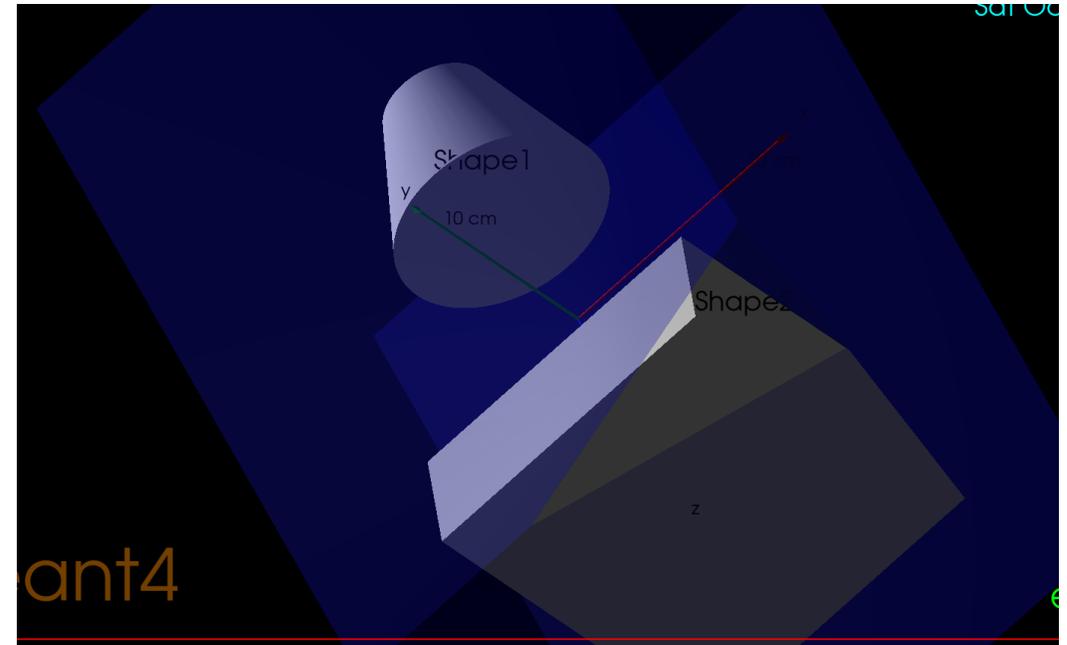
Laurie Nevay
CERN

VTK Status

- Little code update since last collaboration meeting
- Qt5/Qt6 issues are not a significant problem (although still untested on windows)
- VTK suffered from this years MT locking issue, fixed by GB
- Hardly used apart from specialist applications

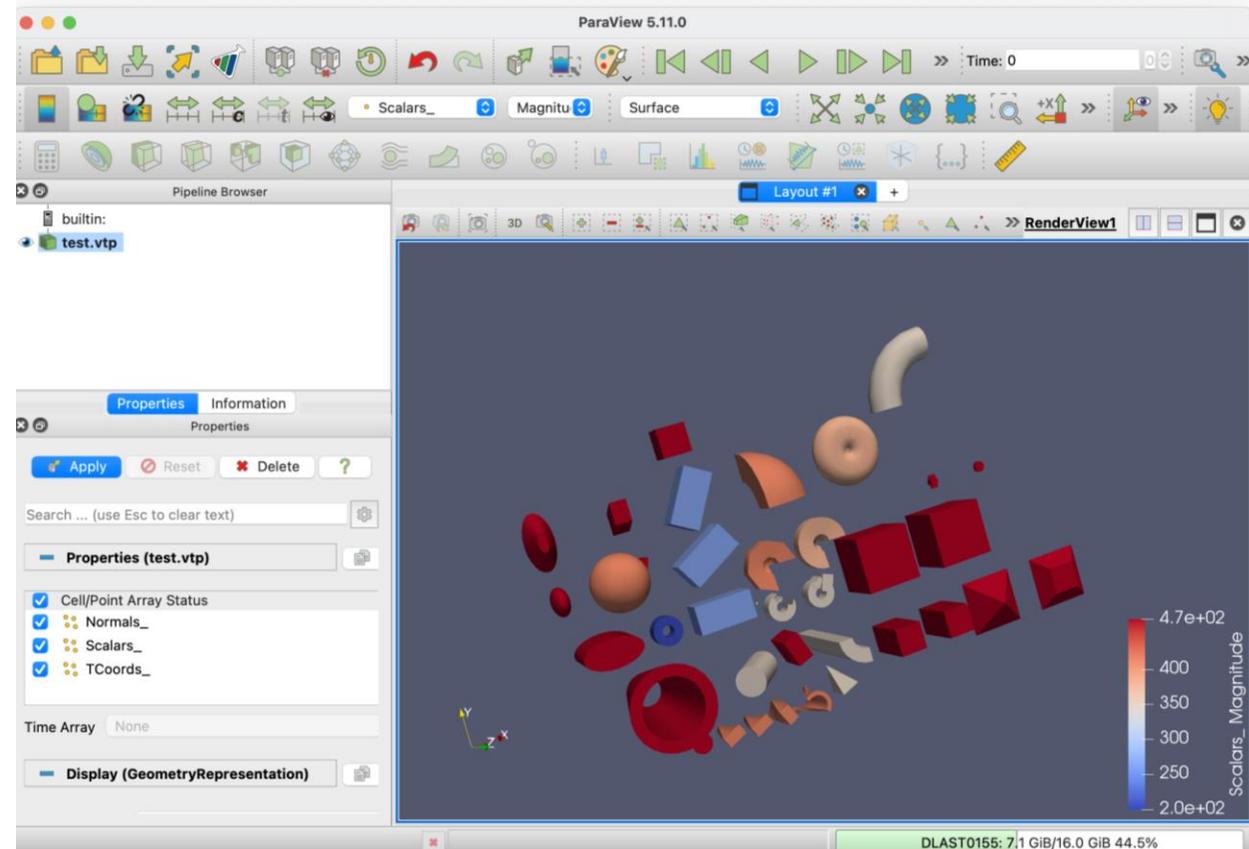
Minor issues to resolve

- Near frustrum plane setting
- Hard to see but B1 example the outer transparent blue solid is cut
- Should be simple enough to fix but as is, it will probably surprise users



Modern geometry export

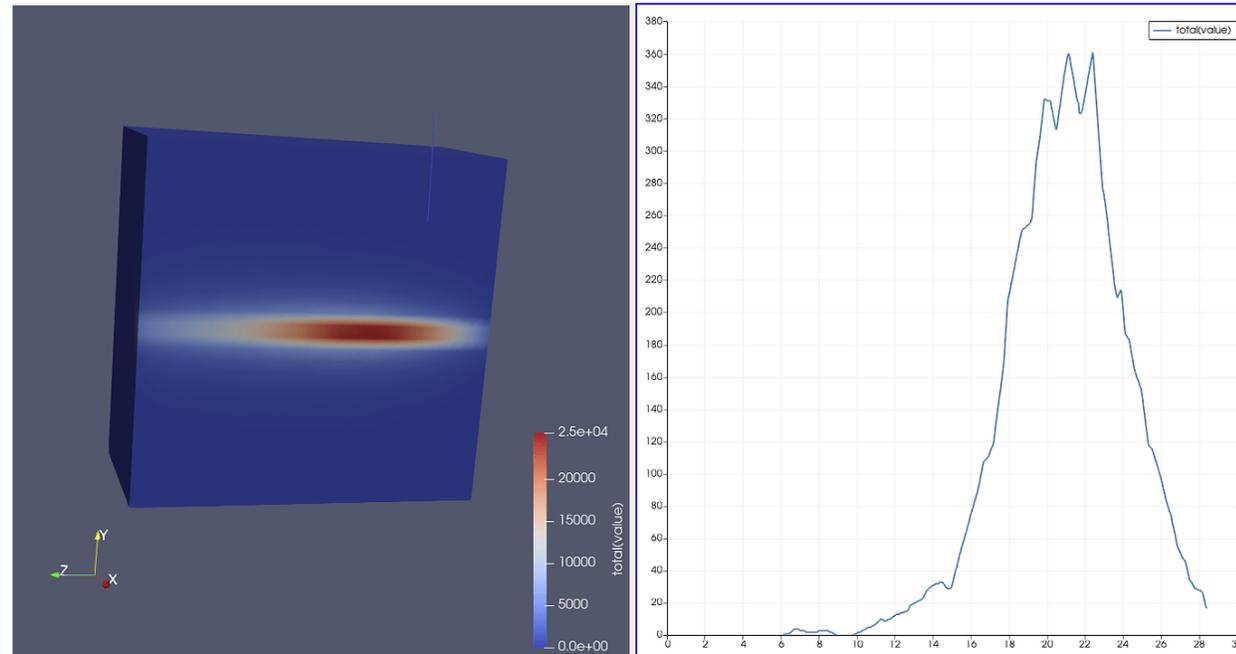
- VTK can export to
 - USD, GLTF, OBJ, VTP, JSON
- VTP allows integration with Paraview and high-end visualization
- GLTF/USD allows high quality renders
 - Actively used by some in CERN OpenLab. For G4/GDML Omniverse integration



Viewing of scoring mesh in Paraview

Hi Stewart,

Yup, I am using your vtk viewer. This is useful though the visualisation driver has already proven useful. For instance the above was an export of a visualisation of a scoring mesh from RE03 run4.mac. It didn't actually export the data as far as I can tell only the colour gradient.

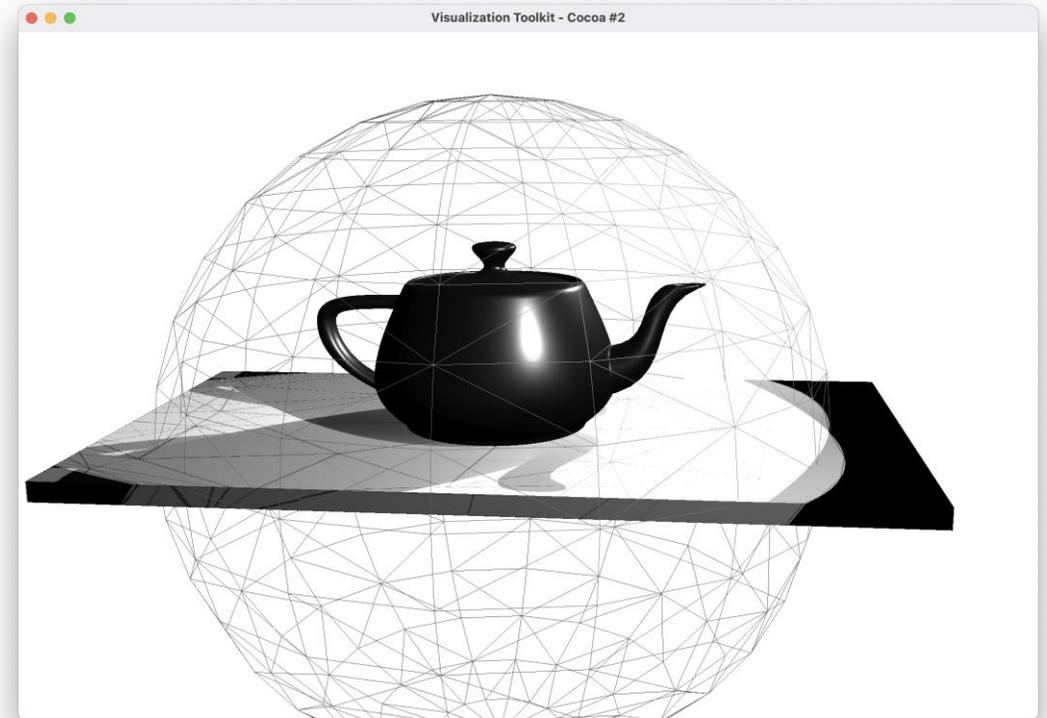


This is a picture of a mesh that I visualised in paraview, with the right hand side being a plot of the intensity across the arbitrary location i chose. Its pretty useful though if I was plotting an effective energy spectrum at that location it would be ideal if we had access to ROOT fit functions. So either ROOT or paraview needs to develop a plugin to have this plot over line feature or import ROOT functions for fitting.

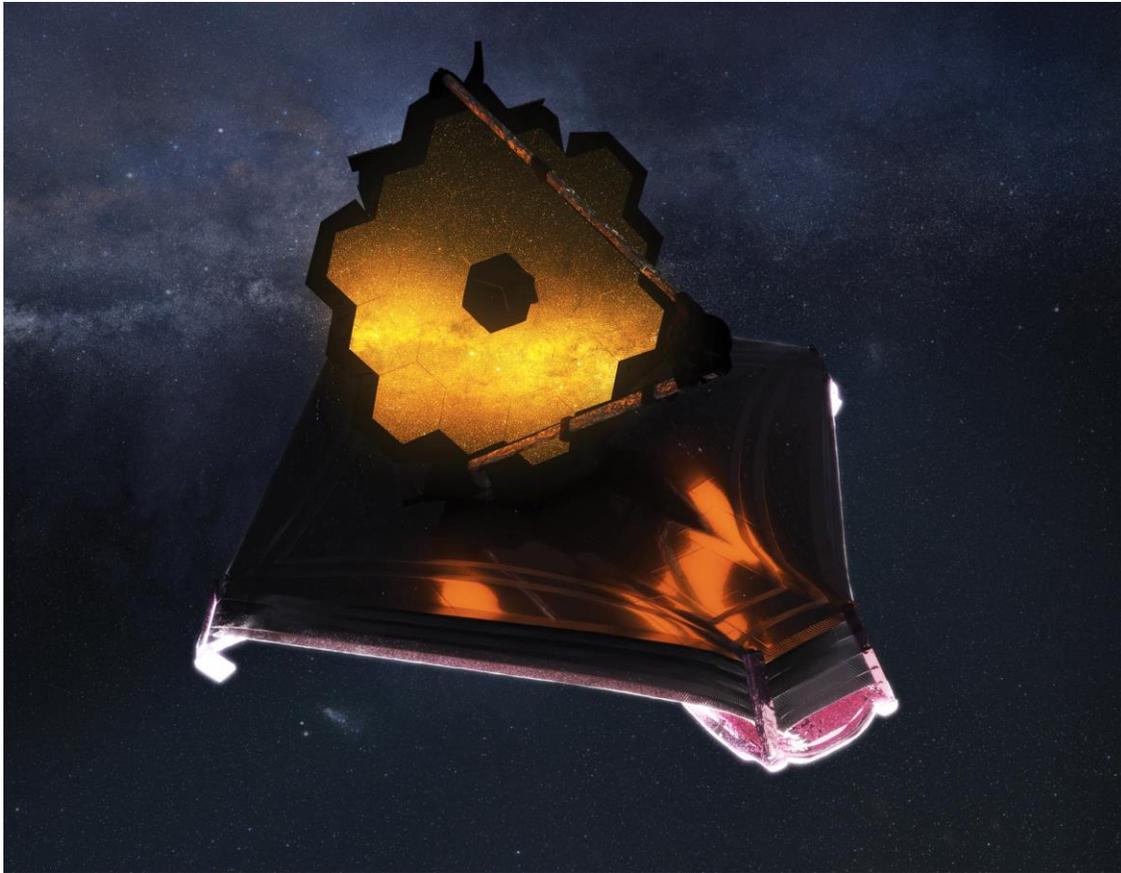
The vtp export can in theory allow you to superimpose this information over the geometry in order to make interpretation more intuitive. QuickTime Player, though direct access to track information from the vtk export in paraview would be quite nice.

Higher end rendering in G4

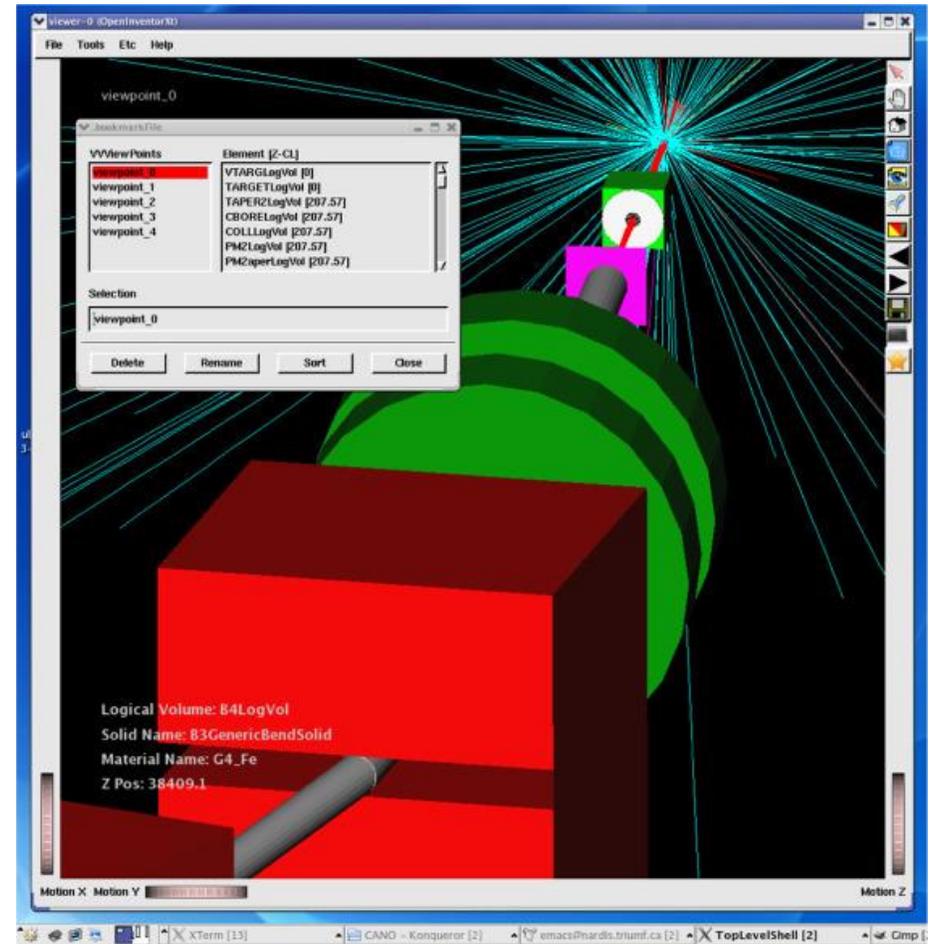
- Physically based rendering (PBR) is probably now the standard compared to Gouraud or Phong
- Shadows are relatively straight forward
- Have G4 produce outreach and high-end visualisations with relative ease. Prototyped already in Pyg4ometry (same VTK base as G4 driver)
 - Cost is 5-10 lines of code for PBR and shadows



Why bother?

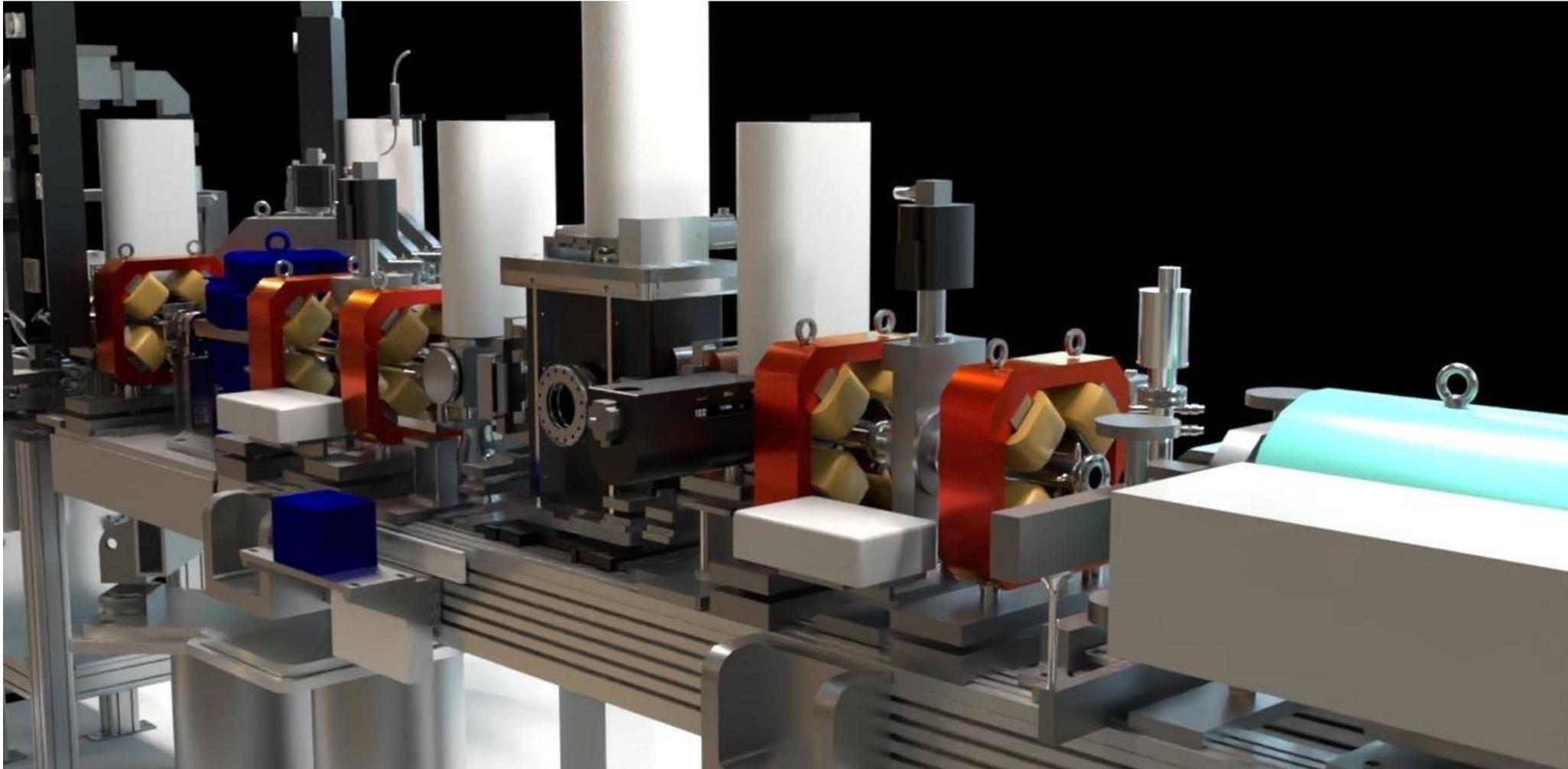


James Webb space telescope : NASA



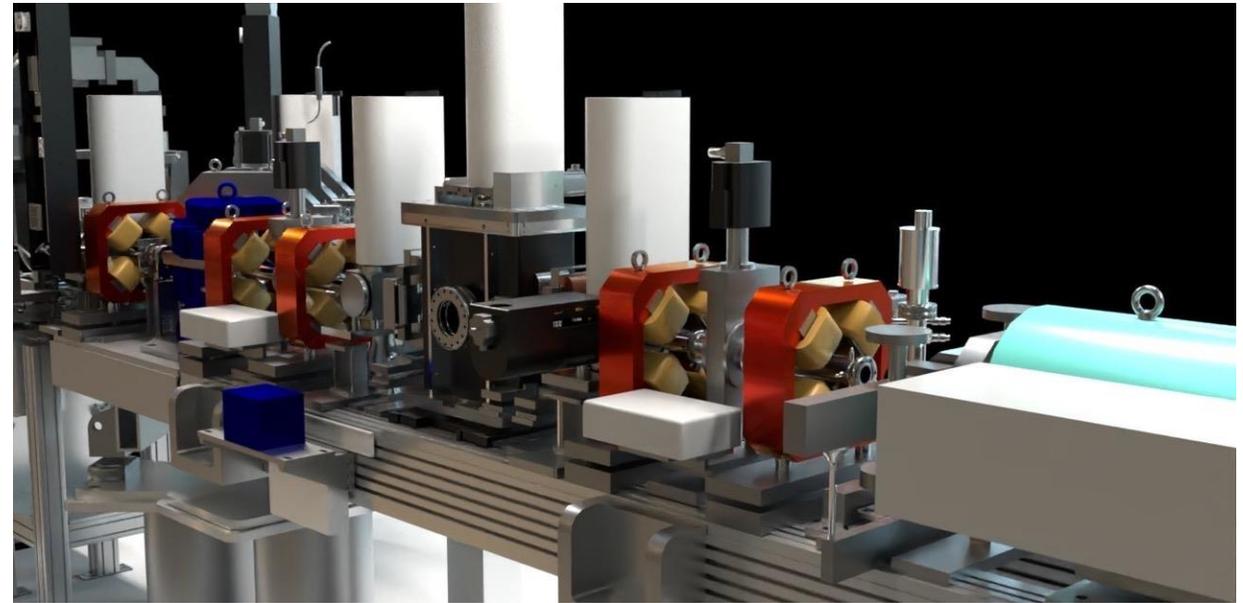
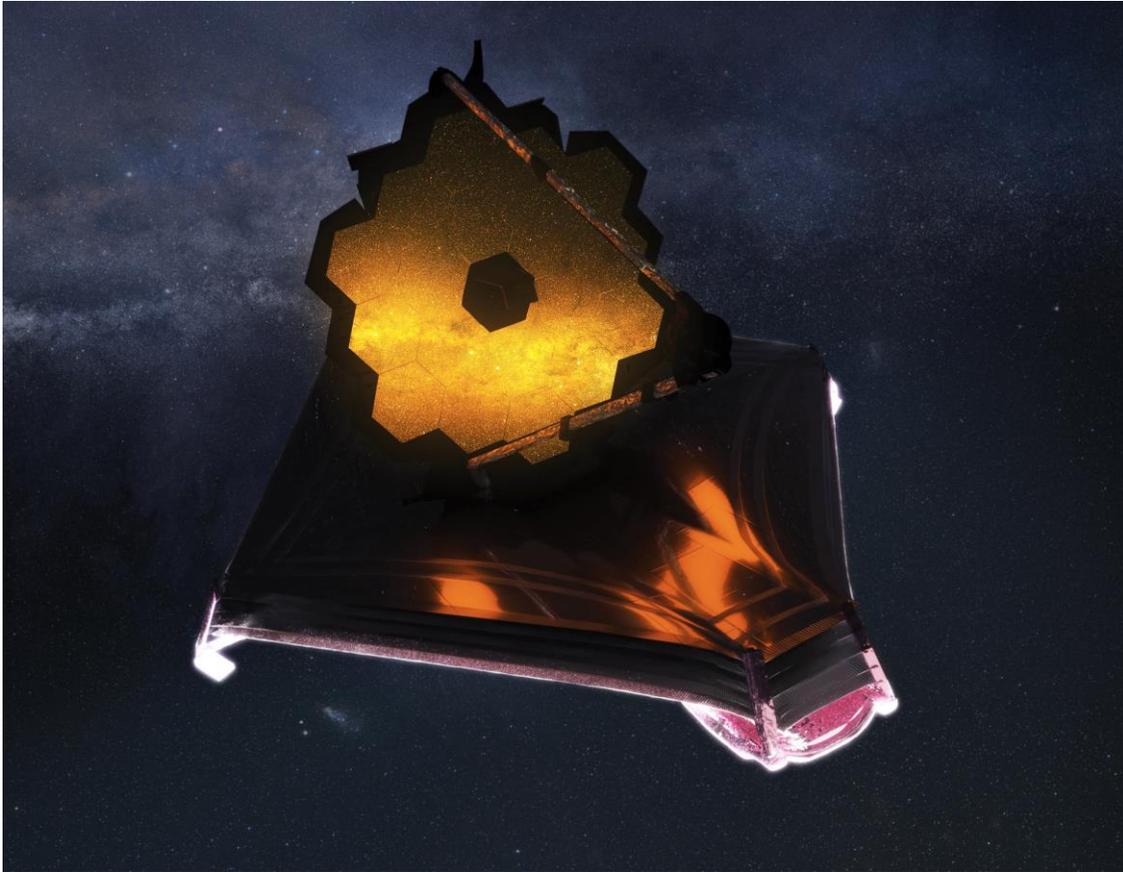
Beamline example : Geant4

Examples of renders that are possible



USD/GLTF export then import and re-render in Houdini : CLARA front end at Daresbury laboratory

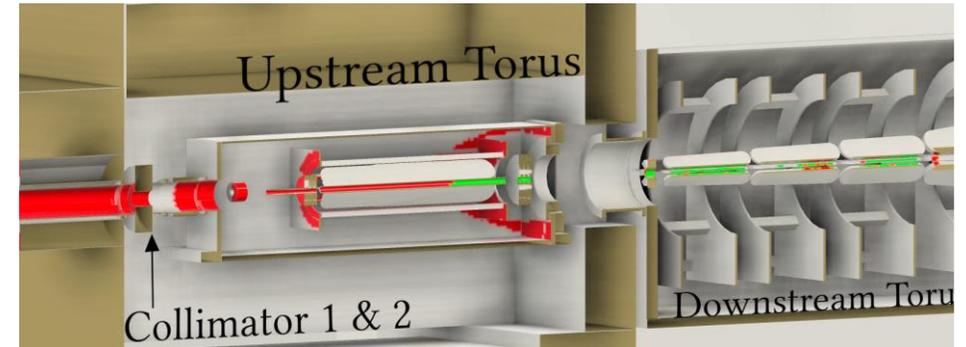
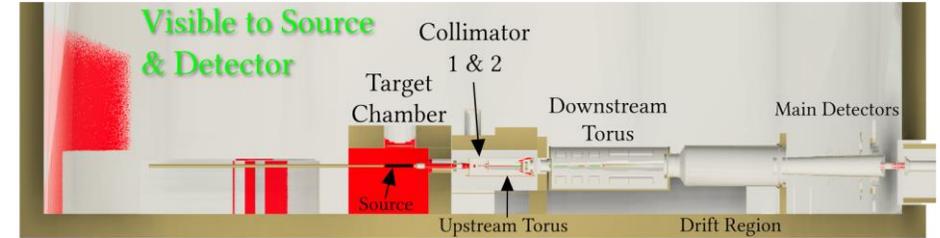
Why bother?



Possible summer student project to implement in G4

All outreach and no science?

- Optical ray tracing for the MOLLER experiment at JLab
- Need to export to mesh format for multiple optical reflection background search
- What about long-term integration with ray tracers?

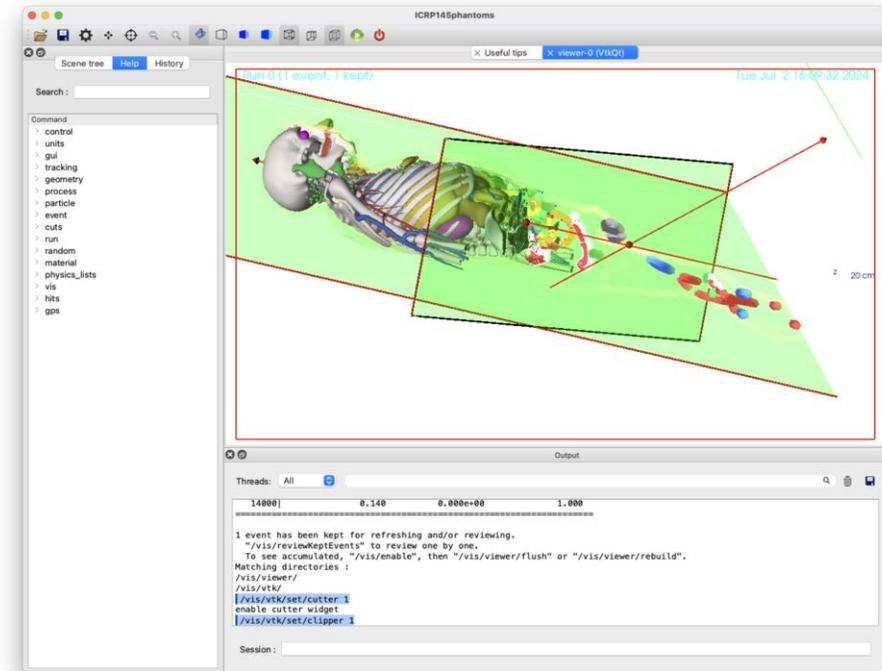


Was an undergraduate project

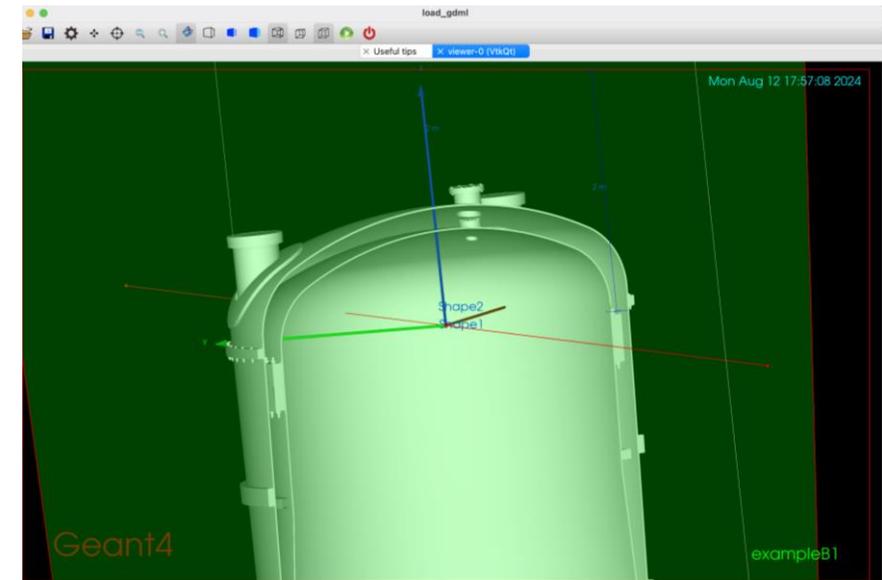
Cutters and clippers

- Cutting
 - Producing a 2D line data of a 3D plane section through a geometry essential for displaying data
- Clipping
 - Removal of geometry
 - Excellent for exploring geometry
- Interactive (i.e 60Hz) and almost independent of geometry complexity.

ICRP145



LZ (+
CGAL
Boolean
engine)



Summary

- VTK, yup it works
- Few users (estimate ~5), those who do have a very specific reason.
- Requires very little support (as heavy lift done by VTK community)
- Geant4 benefits from vis improvements from almost the entire scientific user community